

### Remarks

Contrary to what the Examiner states, the Applicants submit that **US-5686790** to Curtin does not anticipate the subject matter of present claim 1.

Curtin discloses a panel display comprising a substrate having an array of addressable light emitting devices, the array having a light emitting display side facing a first direction. The panel display comprises drive circuitry (204) for said array of light emitting devices for driving said light emitting devices to display an arbitrary image. Electrical connections from the light emitting devices to the drive circuitry are provided (vias 251c, trace 251f, solder bumps 209).

However, in particular, Curtin does not disclose the driver circuitry being spaced apart from the array in such a manner that at least one cooling channel is defined between the array and the drive circuitry for extraction of heat from the array and the drive circuitry by passage of a cooling fluid through the cooling channel. Neither does Curtin disclose that the cooling channel is sealed with respect to both the array of addressable light emitting devices and with respect to the drive circuitry for said array of light emitting devices.

As can be seen in Fig. 11 of Curtin, cooling channels 1101a are provided in the prior art display panel. However, the driver circuitry is formed on a surface of the backplate (col.10 lines 65-66), e.g. on the exterior surface (col.10 lines 14-15). As can be appreciated a.o. from Fig. 11, when passing cooling fluid through the cooling channels, the back side of the array of addressable light emitting devices will be cooled, but not the driver circuitry 204 at the backside of the backplate.

Therefore, Curtin does not disclose each and every feature of present claim 1, and claim 1 is submitted to not be anticipated by Curtin.

Furthermore, claim 1 is considered non-obvious. Curtin does not disclose a solution to how to obtain an improved cooling which is particularly useful in case of a tiled array, nor does it hint in

the direction of such solution. Such improved cooling is obtained in accordance with the present invention by providing the drive circuitry spaced apart from the array such that a cooling channel is defined between the array and the drive circuitry.

**US-6201346** to Kusaka discloses (see Fig. 8) a panel display comprising an array of light emitting devices (2), drive circuitry (7, 8) spaced apart from the array of light emitting devices (2) and electrical connections (6) from the light emitting devices (2) to the drive circuitry (7, 8). The light emitting elements (2) are formed on the upper surface of a substrate (board 1), and the drivers are formed on the lower surface of the substrate (1).

In another embodiment, Kusaka does provide means (9, 10) for cooling the light emitting devices (2) – see also col.8 lines 8 to 56 and Fig. 16 and 17 . In this case, the light emitting devices are connected to drivers formed on another board (col.8 lines 19-20). Kusaka does not disclose, however, cooling of the driver circuit, let alone a simultaneous cooling of display and driver. In particular, Kusaka does not disclose a cooling channel between the drive circuitry (7, 8) and the array of light emitting devices (2). When heat radiation fins are present, as in Fig. 16, the light emitting devices are connected by flexible leads to drivers on another board (col. 8 line 20).

**US-6496370** to Geusic discloses two chips (125, 130) connected to each other, with an interposer (110; 400) comprising at least one cooling channel (116; 402, 404, 406) in between them. It describes a compact cooling method for cooling electronic assemblies consisting of chips. The cooling channels are etched in two semiconductor wafers, resulting in small, accurate cooling channels (col.4 lines 10-11). The application which Geusic describes is cooling of electronic assemblies comprising for example a microprocessor chip (125) and a memory (130).

A straight-forward combination of Kusaka and Geusic would lead to a panel display with an array of light emitting devices and drive circuitry spaced apart from each other, and with electrical connections from the light emitting devices to the driver circuitry. Possibly heat radiation fins are provided to cool the light emitting devices, in which case the driver circuitry is

made on a different board than the light emitting devices. The cooling disclosed in Geusic may be used to cool chips, i.e. the cooling channels of Geusic should be implemented in the driver chip. Therefore, the straight-forward combination of Kusaka and Geusic does not disclose a cooling channel being defined between the array of light emitting elements and the drive circuitry for extraction of heat from the array and the drive circuitry, but rather discloses radiation fins on the array of light emitting devices and one or more cooling channels in the driver chip. It does not disclose the drive circuit being spaced apart from said array in such a manner that at least one cooling channel is defined between the array and the drive circuitry for extraction of heat from said array and said device circuitry by passage of a cooling fluid through the cooling channel.

Hence, at least one criterion of MPEP §2142 is not fulfilled, being that the prior art must teach or suggest all claim limitations. For at least this reason, the office action does not establish a prima facie obviousness rejection, which would put the burden of proof of evidence for obviousness to the applicant (see MPEP §2142 first paragraph).

In view of the above, claim 1 is considered to be novel and non-obvious over a combination of Kusaka and Geusic.

Claims 2 to 13 are considered to be novel and non-obvious over Curtin and a combination of Kusaka and Geusic in view of their dependency on claim 1.

Claims 14 to 16 describe a tiled display formed from a plurality of display panels as disclosed in claim 1. As claim 1 is considered novel and non-obvious, claims 14 to 16 are considered novel and non-obvious as well.

\* \* \* \* \*

Other prior art, not relied upon by the Examiner is considered below.

**EP-0559124** discloses an illuminating display device for use with a mosaic panel. It deals with the problem of heating of the display surface due to heat generated by the light-emitting diodes (col.2 lines 17-26). It discloses a substrate having an array of light emitting devices (circuit board 5 with on its surface a large number of LEDs 9 arrayed in a matrix – col. 5 lines 15 to 18), the array having a light emitting display side facing in a first direction; drive circuitry (driving unit 17) for the array of light emitting devices for driving said light emitting devices to display an image; electrical connections (lead wires 16) from the light emitting devices to the drive circuitry, said electrical connections extending from a rear side of the substrate in a second direction opposed to the first direction (Fig. 3, Fig. 4). The drive circuitry is spaced apart from the array as can be seen in Fig. 3 and Fig. 4.

EP-0559124 discloses cooling the array of light emitting elements by conducting heat via the base seat (4a) of the base frame (4) which is a good thermal conductor, the leg (4b) and the metallic grid (2), which is also a good thermal conductor, with the result that heat is dispersed to the whole grid (col.6 lines 35 to 43). Furthermore, another part of heat is radiated from the surface of the circuit board (5) and the surface of the base frame (4) into the atmosphere.

However, contrary to the present invention, no cooling channel is defined between the array and the drive circuitry for extraction of heat from said array and said drive circuitry by passage of a cooling fluid through the cooling channel. EP-0559124 is silent about cooling of the drive circuitry. Heat radiated from the surface of the base frame (4) into the atmosphere will heat up the air in the space between the display device (1) and the driving unit (17). What EP-0559124 achieves is that the air in that space is heated less than in prior art assemblies, and hence the driving unit is adversely affected by the heat to a lesser extent than in prior art assemblies. However, the present invention proposes a still better solution for this problem by providing a cooling channel between the array and the drive circuitry.

**JP-06202566** reports about cooling a display. The display described comprises: a substrate having an array of addressable light emitting devices (a body 3 having a display part 4 formed by

disposing many LEDs), the array having a light emitting display side facing in a first direction (display part 4 is formed on the transparent material side 2, see Fig. 2); an input means for inputting an arbitrary image and drive circuitry for said array of light emitting devices for driving said light emitting devices to display the arbitrary image (§0003: the aggregate of LEDs may be energized and a predetermined character, a predetermined figure, etc. may be displayed); electrical connections from said light emitting devices to the drive circuitry.

JP-06202566 does not disclose that the electrical connections extend from a rear side of the substrate nor that the drive circuitry is spaced apart from the array in such a manner that a cooling channel is defined between the array and the drive circuitry of the passage in use of a cooling fluid, as in the present invention. Hence JP-06202566 does not disclose that such cooling channel would be sealed with respect to both the array of addressable light emitting devices and with respect to the drive circuitry.

**US-6154362** reports the use of a cooling channel for cooling a display and the use of heat sinks. The display described comprises: a substrate having addressable pixels (pixels formed by three LEDs mounted on a substrate), the pixels having a light emitting display side facing in a first direction; an input means which supplies the picture signal to the cell substrate to drive the pixels in the display cells; electrical connections from the rear surface side of the display cell to the cell substrate mounted in the unit portion (display cell and unit portion drawn in Fig. 3, with cell substrate mounted in the unit portion; a prescribed gap (ventilation passage) between the display cell and the front surface of the unit portion.

However, the cooling channel, the cell substrate (driving circuitry) and the display array are organized in such a manner that the cooling fluid first passes the circuitry and then passes through the ventilation passage. Depending on the temperature of the circuitry, this could lead to a less efficient cooling of the display array. Furthermore, the cooling fluid leaves the display at the viewing side of the display flowing over the pixel surfaces, which could heat the pixel

surface, depending on the temperature of the pixel surface and the temperature of the already heated cooling fluid.

Hence US-6154362 does not disclose the feature of the cooling channel being sealed from the array of light emitting devices.

**EP-0210274** reports the invention of an information apparatus equipped with heat dissipation holes. The apparatus comprises LEDs arrayed in a checkerboard pattern; input means to send a control signal to the display nit lighting the LEDs (p.10: information is displayed by selecting one or more display patterns from several display patterns stored previously); electrical connections from the back face of the substrate.

EP-0210274 does not disclose the separation of the display unit and the driving circuitry with a cooling channel in between, the cooling channel being sealed with respect to both the array of addressable light emitting devices and with respect to the drive circuitry, contrary to the present invention.

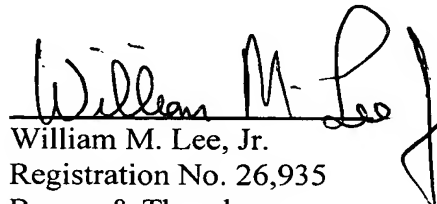
**US-5993027** suggests the use of a cooling channel in a backlight system. The system comprises a set of lamps emitting in a first directon; an electric circuit portion byt there are no input means for inputting an arbitrary image, as the system described is a backlight. The system further comprises the separation of the lamp unit and the electric circuit portion by a cooling channel (see Fig. 1, nr. 9).

The extension of such backlight system to an emissive display is certainly not obvious.

In view of the foregoing, it is submitted that this application, as claimed, distinguishes from the prior art and is allowable thereover. The Examiner's further and favorable reconsideration in that regard is urged.

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Respectfully submitted,

A handwritten signature in black ink, appearing to read "William M. Lee, Jr.", is written over a horizontal line. The signature is stylized with a large, looped "L" at the end.

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